RENAL VARIX.

ANGIOMATOUS DISEASE OF THE PAPILLÆ RENALES.*

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THE object of the present note is to submit certain observations which seem to establish a definite pathological lesion for a hitherto indefinite condition, and to place upon a sound rational basis a method of treatment which hitherto has held only an empirical footing.

It is not necessary to review at length all the theories concerning the etiology of the unexplained cases of so-called idiopathic, essential, or symptomless hemorrhage from the kidney. It is sufficient to say that even the present-day writers employ the expression "essential hæmaturia" to designate those cases of hemorrhage from the kidney that arise suddenly, without warning, without discoverable cause, and devoid of symptom other than the presence of considerable blood in the urine and the consequent anæmia that accompanies it. The disease, when all the facts are known, is not easily confused with other conditions of the kidney which give rise to hemorrhage. Even if the diagnosis be obscure before operation, exploration of the kidney differentiates it from neoplastic disease, tuberculosis, calculus, stricture, and nephritis.

The history of all the cases is very much alike. The patient, usually in good health, suddenly notices the presence of blood in his urine. There is nothing to account for its presence; there has been no undue exercise, no injury, no infection, no history of renal colic; no pus cells, epithelial elements, crystals, tubercle bacilli, or other abnormal ingredients are found in the urine, other than blood, which is at first small in amount, then either increasing or decreasing, and often at times absent altogether; in some cases, the amount of blood is influenced by exercise, while in others this plays no part. In two cases of my own, the quantity of blood seemed to be greater in the morning and to lessen as the day advanced. It occurs with varying frequency in both men and women over twenty-five years of age. Some patients have had alcoholic habits, while others have been total abstainers; in fact, there is no type nor class of person in whom the disease has been more frequently observed. The hemorrhage may last but a few days, only to disappear and recur again after periods of weeks or months or even years; or, again, it may be continuous from the first, causing progressive anæmia.

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As a rule, the urine is loaded with blood and, at times, with free hæmoglobin; the blood-cells are evenly distributed throughout the urine, appearing in all parts of it as it is evacuated from the bladder; clots may be found in the bladder, to be expelled at intervals; as the specimen stands, the cells rapidly fall to the bottom of the glass container; and it has been observed in my own cases that the urine retains its reddish color after precipitation of the cells, probably due to free hæmoglobin.

The urine shows no evidence of renal disease other than a reaction for albumin in proportion to the amount of accompanying blood serum, excepting where nephritis is present—a condition which of itself may give rise to hæmaturia, but which should not be classed with the cases under consideration.

Rarely the patients complain of pain or distress in the affected kidney or over the bladder, but it has been observed in some cases that all the pain and discomfort have been referred to the opposite kidney. The disease is always unilateral; and no cases, so far as I can learn, have ever been reported where the disease affected both kidneys. It is true that symptomless hæmaturia is frequently bilateral; but those are the cases due to malaria, hæmophilia, drug-poisoning, nephritis, or other cause quite different from those included in the present report.

DIAGNOSIS.—The first consideration is the history which the patient presents, such as has been described above. One naturally thinks first of malignant disease, papilloma, hypernephroma, malaria, nephritis, hæmophilia, or renal varix; more rarely of stones or tuberculosis.

It is not essential in the present paper to go over all the causes of hæmaturia in discussing the establishment of a diagnosis. It is necessary, in the first place, to exclude the urethra, the prostate, the bladder, and the ureter as sources of the bleeding; and there are but two ways in which this can be done with accuracy, (1) by surgical operation and (2) by the use of the cystoscope; of the two methods, the cystoscope is the more accurate, although errors have been recorded in both cases. By the aid of the cystoscope and the ureteral catheter we determine that the bleeding is coming from one or the other kidney; this is the most important point of all, and it then only remains to determine what is the probable cause of the hemorrhage. There are some cases where, owing to the large amount of blood present at all times in the urine, it is almost impossible to make a satisfactory cystoscopic examination; if repeated washings of the bladder do not clear up the blood, the bleeding is more probably of bladder origin, but if this can not be definitely made out, in the presence of the symptoms of renal varix it is indicated to do an exploratory operation upon the kidney.

By the aid of the X-ray or the wax-tipped ureteral catheter, the presence or absence of stone can be determined with considerable accuracy; aside from this, the symptoms of renal colic, together with a transitory and insignificant amount of blood in the urine, and the entire symptom-complex, as a rule, are sufficient to differentiate it from renal varix; but in some cases nephrotomy is necessary to the final establishment of a diagnosis.

Chronic nephritis, with unilateral hæmaturia, is probably the most difficult disease to exclude, and this is not always possible even at operation.

In a case reported by Freeman,[1] the only clinical difference to be noted from a diagnostic standpoint was that casts were found; and these were not definitely made out until after operation.

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[1] Freeman, L.: Annals of Surgery, vol. xxxix, 1904, p. 370.

In tuberculosis of the kidney, the bleeding has in our own experience been so insignificant that it should never be confused with renal varix; in addition, pus will always be found and, at some period, tubercle bacilli with other systemic expressions of the disease.

Neoplasms of the kidney are not so easily differentiated; many times it is impossible until after the kidney has been laid open to say definitely that a new growth is not present. However, except in the case of papilloma of the kidney, which is extremely rare, the bleeding is markedly less in amount, is more influenced by exercise, and the cachexia is more extensive in proportion to the loss of blood.

ANALYSIS OF REPORTED CASES.—In March, 1893, Dr. A. L. Stavely reported, in the *Johns Hopkins Hospital Bulletin*, vol. iv, p. 25, two cases of hæmaturia with catheterization of ureters and exploratory nephrectomy.

CASE I.—The first case was a patient aged 39 years, married seventeen years and mother of five children; two weeks after the birth of the last child she found that her urine was deeply stained with blood, and contained clots; this lasted but a day, and there were no other symptoms. Six months later, blood again appeared in the urine, remaining for one day; after that, attacks of hæmaturia occurred with greater frequency and persisted a longer time, until a year before her admission to the hospital, when they appeared every two weeks and lasted a week each time.

Five weeks previous to her admission to the hospital she had constant hæmaturia and was passing urine with great frequency, while a few days before entering the hospital she expectorated a few clots of bright blood and mucus streaked with blood; there was a family history of tuberculosis. She was well nourished, but extremely anæmic; bowels regular; had hemorrhoids and a slight prolapse of the rectum; slight œdema of the feet; passing urine every two hours; temperature and pulse normal; signs of consolidation of the apex of the right lung; heart negative; kidneys not palpable. Blood count showed 3,172,000 red corpuscles and 10,000 leucocytes; hæmoglobin was 45 per cent. Specimens of urine examined two hours after passing showed 110,000 red blood-cells to the cubic millimetre; by this it was estimated that she lost 17 c.c. of blood in 24 hours. Some flat epithelial cells were found in addition to the blood; no tubercle bacilli were found.

Cystoscopic examination showed the bladder to be clear; urine collected from the left kidney was acid, contained a large number of red blood-cells, some leucocytes, a few amorphous urates, ureteral cells in groups and singly. The right ureter could not be catheterized. An incision was made in the base of the bladder and the right ureter orifice exposed and catheterized, the catheter passing to the pelvis of the right kidney; the urine from the right kidney contained a trace of blood, probably due to traumatism. The left kidney was exposed and bisected, and no point of disease either in the pelvis or in the parenchyma could be found. The kidney was sutured with interrupted catgut and the wound closed.

Two days after operation the urine still contained blood; two weeks after operation there was no trace of blood in the urine and the patient was discharged cured. She is reported to have had a slight recurrence, but this is doubtful.

CASE II.—The second case was also a woman; she had been married seventeen years; one child and four abortions, the last one two years ago. She was well nourished but very anæmic, with a history of various cardiac pains, headache, nausea, and poor appetite. A year previously she had developed hæmaturia and it had continued without interruption up to the date of her admission to the hospital; it appeared suddenly, was accompanied by no bad symptoms, and became worse the longer it lasted; besides the gradual increase in the quantity of blood passed she noticed occasional exacerbations. Physical examination of the chest was negative. Vaginal examination showed relaxed outlet and sagging of the uterus. Examination of the urine showed specific gravity 1.020; slightly acid reaction; large quantity of albumin, and a heavy, dark-red, uncoagulated sediment.

Microscopical examination showed numerous red blood-corpuscles, a few leucocytes, and a few large, flat, epithelial cells, but no casts.

Cystoscopic examination showed no abnormalities of the bladder; urine from the left kidney was dark with contained blood-cells; there were a few leucocytes and large epithelial cells; reaction slightly acid. Urine from the right kidney was a clear amber color and contained several epithelial cells; reaction strongly acid; no albumin. On mixing the urines from the right and left kidneys the color was found the same as that discharged from the bladder.

Operation was done by Dr. Kelly. The kidney was incised along the back, extending two-thirds of its length and down into the pelvis; the pelvis and all other parts of the kidney were carefully examined and no evidence of any disease was found. A piece was then removed for microscopic examination and the wound closed with interrupted catgut sutures, and the organ returned.

The day following the operation the urine presented a reddish-black color; specific gravity 1.025; reaction neutral; large amount of albumin; heavy reddish-black sediment; large number of blood elements; hyaline and blood casts and renal epithelium. The fourth day this had cleared up to a great extent. On the fifteenth day the urine was perfectly clear had a specific gravity of 1.016, with only a trace of albumin and a few pus cells. On the nineteenth day the patient was discharged from the hospital, and her urine was absolutely free from red blood-corpuscles.

The microscopical examination of the section of this kidney, made by Dr. Flexner, was reported as follows:

"The section of the kidney passes through a part of the cortex only; just beneath the capsule the tubes are a little atrophied and a number of fibroblasts are visible in such places. Around some few glomeruli the capsule of Bowman is thickened slightly and these glomeruli are correspondingly atrophied. In such areas there is an increased number of fibroblasts between the tubes; the epithelium of the convoluted tubules is granular, swollen, and somewhat broken up; a few epithelial cells are found in which the nuclei are absent; no blood in the tubules seen in the section."

In commenting on this case the reporter says that the etiology still remains obscure in spite of the fact that the disease was localized in one kidney, and that the kidney alone must be considered the source of the hemorrhage. The careful examination and palpation of the pelvis of the kidney was sufficient to exclude neoplasm or calculus; further, there was no reason to suspect acute Bright's disease in either case, and there had not been any acute fever nor had the patient been subjected to the influence of any toxic agent.

The facts which the writer of this paper would emphasize in reviewing these cases are, that they present the typical symptoms, as outlined above, of renal varix; that they both were unilateral renal affections; that in the first case were present varices of the hemorrhoidal veins; that in neither case was any nephritis present; that in neither case were sections made of the papillæ; that in the second case a microscopical examination of the cortical portion of the kidney demonstrated blood absent in the tubules, proving the hemorrhage to have originated in the papillæ; and, lastly, in both cases, nephrotomy and complete section of the large connecting veins of the kidney was followed by uneventful recovery.

Of a series of seventy cases collected by Bunts,[2] in which the source of the hemorrhage was undoubtedly the kidney, in all, with two exceptions, no adequate cause for the bleeding could be found. Not all the histories in this series are complete. The duration of the hemorrhage in these cases ranged from fourteen days to twelve years, averaging twenty months. Nephrotomy was performed in thirty-eight cases, with a secondary nephrectomy in three cases. Nephrorrhaphy for movable kidney was done in three cases. In this series there was no recurrence of hemorrhage reported in forty-one cases; in two cases the hemorrhage was reported as continuous, and in both of these cases blood-casts were present before operation. In a few cases the hæmaturia returned after a period of one, one-and-a-half, two, and three years. It is noteworthy that relatively few of these cases were subjected to microscopic examination, and in none of this series were both kidneys affected.

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[2] Bunts, F. E.: Cleveland Medical Journal, June, 1908.

Dowd[3] reported the case of a man, forty-nine years of age, who began to suffer from painless hæmaturia nine years ago; it lasted for two years, ceased for four years, then recurred, and had been continuous for the past three years. The urine contained about one-fifth its volume of blood; the bleeding was usually less when resting. Nephrotomy was done, with complete recovery. After operation, the urine showed a trace of albumin and a few hyaline casts, probably a result of the operation.

Fenwick,[4] of London, first called attention to the occurrence of angioma or capillary nævus of a renal papilla as the cause of painless hæmaturia. He reported three cases in which distinct vascular abnormalities were found in one of the papillæ of the kidney; two of these cases were cured by papillectomy, and one by nephrectomy. In his first case, the vessels of the mucous membrane covering the papilla were markedly varicose; in the second case, a bright red varicose condition similar to the first case was found; in each, recovery followed removal of the affected papilla. In the third case, in which nephrectomy was done, a dark-purple papilla appeared and a little blood was seen oozing from a point in the apex. He also reported three other cases, in two of which simple nephrotomy was done, followed by recovery; and one in which nephrectomy was done and the kidney found to be the seat of subacute nephritis. In the three latter cases, no abnormal condition of the papillæ was definitely made out.

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[3] Dowd, C. N.; Annals of Surgery, vol. xlii, 1905, p. 266.

[4] Fenwick, H.: Clinical Cystoscopy, London, 1904, p. 392.

In March, 1908, Whitney and Cabot[5] reported a case in which the tips of one or two of the papillæ at one end of the kidney were reddened and a little spongy; the microscopical examination showed the small venules at the tip of the papilla irregularly dilated, and covered on their free surface with a fine film of connective tissue and a single layer of epithelial cells, projecting here and there as varicose knuckles; no well-marked thrombi were found. The straight tubules of this region contained blood corpuscles, which were not found higher up, indicating this to be the source of the hemorrhage. MacGowan[6] reports a case of painless hemorrhage of two weeks' standing, in a man aged forty-five years; nephrotomy was done, and one papilla that was dark purple in color and was bleeding continuously was removed by a wedge-shaped incision; the sides were then united by one stitch of fine catgut, the kidney was sutured, and an uneventful recovery followed.

During the past year two cases have come under my personal care which belong properly in this class:

CASE I.—Referred by Dr. William Moser. Man, aged sixty-two years, janitor by occupation, was admitted to the German Hospital of Brooklyn, on August 26, 1908. Family history negative. He did not use alcohol in any form; had never suffered from scarlet fever, rheumatism, diphtheria, or malaria; in 1898 he was ill with pneumonia; has had several attacks of influenza; has had hemorrhoids for several years with occasional bleeding therefrom. In November, 1907, he first noticed blood in his urine; this was shortly after an attack of influenza, and there were no other symptoms referable to the genito-urinary tract excepting some increased frequency of micturition; the hæmaturia was said to have been constant. During the months following, he did not feel well and had occasional attacks of dizziness, weakness, specks before the eyes, etc.; he also suffered from bleeding hemorrhoids.

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[5] Whitney and Cabot: Boston Medical and Surgical Journal, vol. clviii, No. 21.

[6] MacGowan, Granville: American Journal of Urology, June, 1908.

In July, 1908, there was increasing weakness and dizziness, with alternating constipation and diarrhœa; he had no chills or fever, and at no time complained of pain; there was loss of appetite and specks before the eyes, but no tinnitus aurium. August 10, 1908, he began to have indigestion, manifested by vomiting following his meals, unaccompanied by pain or by blood in the vomitus; about the same time there was slight swelling of the ankles, which lasted for only a few days. The urine was constantly loaded with blood, and he often passed clots of blood; he would void his urine three or four times during the night.

In this condition he presented himself for treatment. He had an apathetic expression, and was anæmic rather than cachectic; the eyes were slightly sunken and watery; his temporal and radial vessels showed a very slight arteriosclerosis; he stated that he had lost considerable in weight; his bleeding hemorrhoids had caused him a good deal of suffering.

Examination showed that his heart was slightly enlarged and the first sound reduplicated at the apex; lungs showed signs of consolidation of the right apex; the liver was much decreased in size and was not palpable; abdomen was relaxed; no distention or tenderness; no masses could be felt and there was no ascites; a rectal examination showed dilated hemorrhoidal veins that were oozing; the lymph-nodes were normal; skin showed slight cachexia but no eruptions and no œdema; the lips were anæmic, teeth poor, and tongue coated; neither kidney could be felt; the urine showed a specific gravity of 1.024 and was alkaline in reaction, with a slight amount of albumin, was red in color and heavy with blood-cells and a few leucocytes; the external genitals were normal.

Cystoscopic examination showed some congestion about the mouth of the left ureter, otherwise the mucous membrane of the bladder was normal; no obstruction in either ureter; urine drawn from the left kidney was bloody, that drawn from the right kidney was clear. Patient had been treated with potassium iodide in 5-grain doses, strychnine sulphate, calcium lactate, and by rest in bed; but there had been no difference in the amount of blood in his urine. A probable diagnosis of renal varix was made, and nephrotomy advised; operation was rejected until two weeks later, when his condition became so grave that he at last consented to an operation. At this time his hæmoglobin was found to be 35 per cent.; leucocytes, 15,200; polymorphonuclear leucocytes, 49 per cent.; small lymphocytes, 50 per cent.; eosinophiles, 1 per cent. Morphologically, the cells showed advanced poikilocytosis with marked anæmia; lymphocytes were all small.

In this desperate condition he was subjected to operation, with temperature of 99°, pulse 96, and respirations 22.

Operation, December 12, 1908, by the writer. A rapid nephrectomy was done without any seeming shock to the patient; not more than a drachm of blood was lost during the operation; upon exposing the kidney it was found to be congested and the pelvis was swollen with contained bloody urine; there were no macroscopic changes in the kidney itself. The patient reacted well from the operation and his pulse never went above 112 nor his respirations above 24; during the next twenty-four hours he passed 1300 c.c. of urine; the pulse gradually became slower, and twenty-four hours after the operation his condition was perfectly normal; the urine passed was clear, showing that the source of the hemorrhage had been removed; the dressings were changed and the wound condition was perfectly satisfactory; during the day he felt more comfortable, and at midnight he was sleeping normally, with temperature 98.4°, pulse 90, and respirations 30. Shortly after that it was noticed that his respirations were more rapid, his pulse becoming weaker; at 2 A.M. there was sudden dilatation of the heart, and 2.10 A.M. he died, forty hours after the operation.

Examination of the removed kidney showed it to be normal in size, the parenchyma was normal, and no signs of nephritis were present; there was a small cyst in the cortex filled with clear fluid. Sections were taken from the papillæ, and a typical condition of varix was found; the numerous venous and arterio-capillary spaces were markedly dilated, so that in places there was but a thin wall of cells between a number of blood sinuses, and on the surface the blood sinuses approached so nearly to the mucous membrane that the slightest violence would probably cause their rupture; a rupture of these, however, was not necessary, as a transudation of the blood-cells and of the blood elements would be easy through so thin-walled a vessel if on an exposed surface.

It is to be emphasized that, macroscopically, nothing whatever was discernible in the kidney to indicate the varicose condition of the papillæ. I know of no previous case in which such a condition has been proven to exist; all the cases reported, as already outlined, have shown macroscopic changes that drew the attention of the operator to one or another of the papillæ, and, in some cases, actually oozing points were seen.

In the present case reported, if the kidney had been split and the pelvis inspected, the organ would have been pronounced normal, and only upon microscopic section was it proven that the diagnosis of renal varix as the cause of the hæmaturia was correct.

I believe the actual presence of such a condition to be a very important observation, for it forms a basis for the more accurate treatment of future cases of renal varix that may be encountered.

The patient was evidently predisposed to venous varicosity, as demonstrated by the varicose condition of his hemorrhoidal veins. A varicose condition of the capillary portion of the renal veins is not to be wondered at, as we often have expressions of similar conditions of other tributaries of this vein. It will be remembered that the left renal vein crosses in front of the aorta just below the origin of the superior mesenteric artery; it is covered by the third portion of the duodenum, and receives the left spermatic or the left ovarian vein, and usually the left suprarenal, sometimes, also, the left phrenic vein. There are rudiments of valves in each vein where it joins the vena cava. We frequently see varices of the left spermatic vein, and there has been no satisfactory explanation given as to its occurrence, nor do I undertake to explain the cause of either the right-sided or left-sided renal varix, except to emphasize the fact that its occurrence might frequently be expected.

CASE II.—Referred by Dr. V. W. Weed. Woman, twenty-eight years old. As a child, the patient had an attack of typhoid fever which was followed by some cardiac trouble the exact nature of which is unknown; she also claims to have suffered from malaria. Her menstrual history began at the age of nineteen and shows no marked abnormalities. Married. There is a possible history of specific infection by the Neisser bacillus. She gives a history of burning micturition with frequency and urgency, shortly after marriage; had had no trouble during her pregnancy one year ago; has one child—normal confinement. Four months previous to examination she discovered blood in her urine evenly mixed with the same, and a few drops following the close of micturition; catheter specimen was bloody; there was never any colicky pain; two months ago she began to have some increased frequency of urination; would pass her urine once at night and sometimes not at all; during the day she urinated four or five times; during the last four weeks she complained of pain low down in the right side, but not severe; has lost twenty pounds in weight, and is steadily growing weaker; aside from this she does not complain of anything except the blood that she passed whenever she urinated; she stated that even after a night's rest the urine was as bloody as it was at the end of an active day.

Examination of the patient revealed a woman of slight build, moderately anæmic; heart and lungs normal; the right kidney was slightly enlarged, somewhat tender, and freely movable as far as the pelvic brim; the surface of the kidney was perfectly smooth; the left kidney was slightly movable. Urine: specific gravity, 1.017; acid; trace of albumin; no sugar; blood-cells.

Cystoscopic Examination, April 16, 1908: No abnormalities could be noted in the bladder, with the exception of some thickening of the muscular bands; bladder capacity, 16 oz.; no irritability; urine, as drawn from the bladder by the catheter, was very bloody and contained a large amount of fresh blood, not clotted; there was nothing in the bladder to indicate the source of this hemorrhage; after washing the bladder the medium remained clear for one hour. Ureter openings normal; easily catheterized.

Right Kidney.—Urine flowed with perfect rhythm, drops coming every 15 seconds, averaging 52 drops to the minute; the urine obtained was perfectly clear and contained no blood cells, but was slightly tinged red as if it contained hæmoglobin.

Left Kidney.—Rhythm normal; urine secreted very rapidly, 75 drops to the minute with an interval of 3 seconds between the drops; the urine was perfectly clear, almost the color of water.

Microscopic examination showed moderate number of renal epithelial cells from which there seemed to spring buds without any definite structure.

April 20, 1908, the bladder was again examined and no point of hemorrhage was found therein; urine that came from the right ureter opening was distinctly abnormal. Both ureters were catheterized again, and the urine obtained from the right kidney contained a small amount of blood; that from the left kidney was normal.

Operation, April 30, 1908, at the German Hospital. The kidney was easily delivered through the wound; it was found to be partially turned upon itself, without, however, any torsion of the ureter; the kidney was enlarged, and its central portion seemed to be somewhat grayer in color than the two poles; a pedicle clamp protected by rubber tubing was used to compress the renal vessels. The kidney was then split from pole to pole, a little posterior to its median line, down to the pelvis; no abnormality of any kind could be found. The pelvis was carefully examined and was found perfectly normal in size and position; palpation of the kidney demonstrated no abnormalities. Four mattress sutures of catgut were used to bring the split surfaces of the kidney in due apposition and hold them there; the peripheral edges of the kidney were brought together with catgut sutures; after the clamp was removed—having been in place for about four minutes—there was free oozing from the kidney and it was found necessary to put in a few additional sutures. The kidney was then fixed to the muscular structures by four stay sutures of chromic gut, and the wound closed with the exception of an elliptical space 1½ inches long by ½ inch wide, which was packed with iodoform gauze. The patient stood the operation very well; during the first twenty-four hours there was considerable oozing of blood and urine from the wound, but during the next twenty-four hours this entirely ceased. Pulse, temperature, and respiration normal. An uneventful recovery followed, the wound healing *per primam*.

On the fifth day after the operation there were no microscopic or macroscopic blood elements to be found in the urine. From that day until the present—now ten months—she has remained entirely well and has gained greatly in weight; she has never had the slightest trace of blood in her urine since the operation.

In considering this case, the first point worthy of attention is the fact that the blood had been present in the urine without intermission for four months; that it was just as bad if not worse in the morning as at night; that there was a considerable amount of free hæmoglobin present in the urine; that she was thoroughly anæmic rather than cachectic. No microscopical section was made in this case, and no removal of kidney tissue was done. The clinical condition found at operation and the complete subsequent relief to the bleeding, following the nephrotomy, illustrated in an ideal degree the characteristics of the lesion under discussion.

TREATMENT OF RENAL VARIX.—The beneficial results of nephrotomy in cases of renal varix, as well as in hæmaturia due to other conditions, seem to be due to the peculiar distribution of the venous radicles at the base of the renal calices, as described by Broedel[7]:

> "While there is a complete arterial division in the place connecting the posterior calices and terminating in the lateral path of the upper and lower calices, the veins follow a quite different arrangement. Around the base of the pyramids they anastomose and form venous arches; they unite in long branches and run between the sides of the pyramids and the columns of Bertini to the neck of the calices where they lie between the pyramids and the arterial branches. The thickness of these connecting veins accounts for the peculiar lobulated appearance of the base and sides of the pyramids. Around the necks of the calices, both anteriorly and posteriorly, these veins form a second series of anastomoses, much thicker and larger than at the base of the pyramids; this appears as a number of thick loops or rings which fit like a collar around the necks of the calices; *nearly all the collected blood of the posterior region is carried anteriorly through these short, thick stems* to join that of the anterior portion.
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> "*An incision through the posterior row of calices would avoid all the arteries, but would sever six of these connecting veins;* there remains, however, sufficient anastomosis at the upper and lower pole of the kidney, so that no serious consequence should follow a severance of these veins."

The importance of this arrangement of the venous stems in its relation to the operation for the relief of renal varix will be appreciated when the operation is described.

Palliative Treatment.—In all cases of sudden unexplained hæmaturia in which there is no reason to suspect stone, tuberculosis, trauma, or cystitis, the patient should be immediately put to bed and kept there; the diet should be restricted to milk and broths, and no exercise of any kind should be allowed. Examinations of the blood should be made for malaria, and the condition of the elements of the blood determined at the same time; the rectum should be examined for hemorrhoids, the scrotum for varicocele, and the legs for varicose veins. If the hemorrhage is more than transitory, a complete cystoscopic examination should be made and the exact location of the hemorrhage determined. The best drugs to administer to these patients are calcium lactate, 5 to 10 grains three times a day; Basham's mixture, 1 to 4 drachms in water three times a day; quinine sulphate, 25 grains a day; fluid extract ergot, ½ to 1 drachm every four hours. The exhibition of thyroid extract, adrenalin, and allied preparations is of uncertain value.

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[7] Johns Hopkins Hospital Bulletin, January, 1901, p. 10.

There is still another treatment that might be tried, and that is local applications to the papillæ by means of the ureteral catheter, using tannic acid, iodoform emulsions, alum solutions, or adrenalin chloride. None of these have ever been tried, but in a case where the patient absolutely refused surgical relief I would not hesitate to apply these measures.

Operative Treatment.—Three procedures must be considered under this heading: *Decapsulation of the kidney; bisection of the kidney; removal of the kidney.* In a typical case of renal varix, it does not seem probable to the writer that decapsulation and fixation of the kidney would permanently relieve the hemorrhage, although it would lessen the congestion and certainly tend to diminish the hemorrhage. After a careful study of the cases so far reported of unilateral symptomless hæmaturia in which renal decapsulation and fixation have resulted in recovery, I am able to find but two cases in which sufficient detail is given on which to base an opinion. One case was reported by Broca of a woman twenty-eight years of age, who had suffered from this condition for sixteen months. The urine from the affected kidney showed many granular casts. Decapsulation was done, with recovery, and no recurrence after three years. This was unquestionably a case of hemorrhage in a kidney that was the subject of nephritis; and whether the condition was one of hemorrhagic nephritis rather than renal varix, it is difficult to say. Also, it is impossible to tell exactly in what way the sutures were passed to fix the kidney; if they were passed through the tissue of the kidney they might easily be so located as to restrict the calibre of the veins when they were tied, and in this way materially aid in the lessening of the hemorrhage.

Freeman[8] reported the case of a man 59 years of age, anæmic and emaciated, who first suffered from hæmaturia twenty years previously; it ceased spontaneously but has been repeated many times; the bleeding was profuse and clots were formed; the past year, the bleeding was continuous and was found to be coming from the left kidney. Renal decapsulation was done, and after ten weeks there was no evidence of a hemorrhage, no evidence of nephritis, and no blood-cells. A small piece of the cortex of the kidney, which was removed for examination, showed the tissue to be in an advanced state of arteriosclerosis; also a marked glomerulonephritis, with small-celled infiltration between the tubules. Here again, we have a case in which there was undoubtedly advanced nephritis with profuse hemorrhage from one kidney, which was relieved by decapsulation; but again we must not draw our conclusion without a further knowledge of the operative technic. Fenwick found that twelve per cent. of his cases of unilateral renal hemorrhage showed evidence of chronic granular nephritis.

Nephrotomy is indicated for two reasons: first, it allows a thorough exploration of the pelvis of the kidney; and if the diagnosis has been wrong it will be surely proven, as tubercular disease of the kidney, any new growth, stone, or other abnormality causing the hemorrhage will surely be discovered by this operation. In the second place, *it accomplishes exactly what the operation of multiple ligature does in the treatment of varicosities in other portions of the body. Six of the main collecting venous radicles of the kidney are severed and perma-*

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[8] Annals of Surgery, vol. xxxix, 1904, p. 370.

nently closed, and the course of the blood-stream is instantly changed to the anastomoses at the upper and lower pole of the kidney; the injury to these veins, however, is not of any serious moment.

Technic of the Operation.—The kidney is exposed and an incision is made along Broedel's line; an incision through the middle of the kidney should be avoided because it would cut through larger vessels and cause more injury to the kidney structure, as well as causing more severe hemorrhage. The pelvis is freely opened and the anterior and posterior calices of the kidney thoroughly examined; if there be any gross varicosity of the papillæ, excision or a thermocautery operation may be done; otherwise, the cut surfaces of the kidney are to be brought together with mattress sutures and the organ fixed in position, a small portion of the cortex of the organ being decapsulated for the purpose. The mattress sutures in the kidney are placed at right angles to the large vessels.

Nephrectomy would be indicated, first, when rapid and bloodless operation is demanded; second, when nephrotomy has failed to relieve the hæmaturia.

CONCLUSIONS.

(1) Renal varix is a distinct pathological entity and may be described as an angiomatous disease of the papillæ renales, whose etiology and pathology resemble that of varicocele, varicose veins of the leg, varicosities at the cardiac end of the stomach, hemorrhoidal varices, etc.

(2) Many of the so-called cases of essential hæmaturia are due to this condition of the kidney.

(3) It has its own distinct symptomatology; but it may be impossible to differentiate it, before operation, from hæmaturia due to nephritis and hæmaturia due to renal papilloma.

(4) In the majority of cases, at operation, when the kidney has been bisected, no gross pathological lesions will be noted, but on microscopic examination of the papillæ renales a typical angiomatous disease will be found.

(5) Renal decapsulation and fixation of the kidney will cure the cases of unilateral hæmaturia due to nephritis.

(6) Nephrotomy is the operation of choice, because it allows a thorough examination of the kidney, and also for the reason that it accomplishes exactly what the operation of multiple ligation does in the treatment of varicosities in other portions of the body, in that it cuts six of the main connecting venous radicles of the kidney and in this way destroys the varicosities.

(7) The incision should be made along Broedel's line so as to avoid injury to the arteries.

(8) Nephrectomy is indicated only when rapid and bloodless operation is demanded, or when nephrotomy fails to relieve the hæmaturia.